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Preliminary Note on the Effect of the Direction of Gravity on Lunar Observations. By E. B. H. Wade, M.A.

(*Communicated by Professor H. H. Turner.*)

That the Moon's apparent place is affected by the spheroidal figure of the Earth is well known. If $d\phi$ is the difference between geocentric and geographic latitude, the Moon's declination on the meridian requires a supplementary correction of $p \times \cos \zeta \, d\phi$, which in extreme cases amounts to 1″ for every 1′ of $d\phi$.

Unless this correction is made, latitudes found by altitudes of the Moon will differ to that extent from those found by altitudes of stars. Again, if there be admitted a distinction between geocentric and geographic longitude ($d\lambda$), then the Moon's R.A. at transit requires a correction for parallax $p \cos t \dfrac{\cos \phi}{\cos \delta} d\lambda$, instead of being free from parallax as usually assumed. For every 1′ of $d\lambda$ this means, in equatorial latitudes, 1″ error about in R.A. Now since longitudes found by Moon culmination are about thirty times as erroneous as the R.A. from which they are deduced, we find that if $d\lambda$ attains 1′, the longitude will differ 2^s from that given by star-signals. If this has not been emphasised before, it is no doubt due to the practical certainty that $d\lambda$ cannot attain to 1′, but we shall nevertheless pursue the idea somewhat further.

The 2^s in longitude, though a large quantity, means only 1″ in R.A., not a large quantity perhaps to detect by observation with the transit instrument. In the case of occultations near the meridian, the disappearance would be accelerated or delayed by 2^s, which could not escape observation, as times of disappearance are reliable to $0^s{\cdot}2$. We conclude that a difference of only 6″ between geocentric and geographical longitude has a measurable effect on an occultation.

Application.

It is immaterial to the above argument whether the $d\phi$ or $d\lambda$ arise from (*a*) systematic ellipticity, (*b*) accidental causes (so-called local attraction), (*c*) a regional drift of gravity prevailing over large areas, or any combination of these.

(*a*) We have shown that if this effect attain to 6″ in longitude it will be noticeable, but it would only be detected in geodetic operations if correct to 1 in 45,000, both in the triangulation and in the astronomical work.

(*b*) Is sufficiently detected by ordinary geodetic operations.

(*c*) Might suitably be dealt with by lunar observations.

Major Burrard, R.E., in a paper read to the British Association (*B.A. Report*, 1902, p. 541), expresses a fear that a large

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regional drift may remain uneliminated, so that it is not possible to apply a map of India to a map of the whole world with certainty. As this doubt has been authoritatively expressed, it seems worth while to point out that lunar observation would detect such drift, whether in latitude or longitude. In the case of latitude, that found from the Moon would differ by 1″ from that found from stars, and in the case of longitude that found from occultations would differ 2^s (30″) from that found from star signals, if $d\phi$ or $d\lambda$ attain to 1′.

Or, better, on the same night, longitudes found from occultations at large hour-angles would differ nearly 2^s (30″) from those observed near the meridian.

Occultations appear to be very suitable, but as long as they are corrected for ephemeris errors obtained with transit instruments, they are no better than transit observations. In the case when two occultations are observed on one night, or one in two localities, this objection is removed.

It may be added that a marked discrepancy was found in the fundamental Indian longitude based on a long series of Moon culminations, and the same later determined telegraphically, and this note may help to explain it.

Abbasia Observatory, Egypt: 1903 *October* 26.

Remarks on a Paper by Mr. Cooke on a New Method of Determining Time, Latitude, and Azimuth. By E. B. H. Wade, M.A.

(*Communicated by Professor H. H. Turner.*)

At the beginning of the present year Mr. Cooke described a new method of determining time, latitude, and azimuth (*Monthly Notices, R.A.S.*, vol. lxiii. p. 156). As I have been employing precisely his method since May 1902, I thought it would be permissible to make a few additional remarks on the subject.

Having been instructed to determine the latitude of Tamia in the Fayum Province of Egypt, I proceeded thither with an 8-inch theodolite, intending to rely on circle readings. However, a very strong wind was blowing, and this caused such inconvenience in illuminating graduations, that Talcott's method seemed preferable. For this a vertical micrometer is necessary, and the one furnished with my instrument could not be turned into the vertical without structural alterations. I therefore decided to make my chronometer a substitute for the micrometer. For example, if the second of a pair of stars pass the meridian at a greater altitude than the first, then by placing the instrument out of the meridian for the second star we may still secure it at the same altitude as the first. It at once became evident that

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